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Realising a cloud-enabled economy in Singapore:

How cloud drives economic and societal impact through micro, small, and medium-sized businesses

2023

By 2030, MSMEs can deliver greater societal value in a cloud-enabled Singapore

Across key sectorsⁱ this opportunity is expected to represent:

\$650 million combined annual productivity benefits unlocked through cloud-enabled MSMEs in healthcare and education

This represents a 25% increase on current levels



100,000 people in Singapore employed by cloud-enabled MSMEs within healthcare and education

6 million telehealth consultations using cloud supported by MSMEs' services



200,000 school students engaging in online learning via cloud-enabled MSMEs

MSMEs is the abbreviation of micro, small, and medium enterprises.

Current values are annual 2022-2023 values based on the latest available data.

i. Key societal sectors are healthcare and education.

Overview

Micro, small, and medium enterprises (MSMEs, businesses and startups with between 1 and 250 employees) are a major driver of economic performance. In Singapore, MSMEs collectively account for about 99% of all firms, 65% of jobs, and about 48% of Gross Domestic Product (GDP).¹ MSMEs are also a major source of innovation and disruption in the economy, leveraging both old and new transformative technologies to fill gaps in the current market, and bringing new products and services to bear.

By allowing users to procure on-demand, scalable IT products and services over the internet or a private network, cloud technology has driven economic and societal benefits by creating new business models, reducing costs, and supporting new opportunities for entrepreneurs and startups. Approximately 64% all businesses across Singapore now utilise at least some basic form of cloud technology (such as office software and email), although adoption rates of more advanced technologies, such as artificial intelligence (AI) and machine learning (ML) remain low, at approximately 14% of businesses.^{2,3} Cloud technologies have most profoundly impacted MSMEs by allowing them to start, operate, and scale their operations more effectively.

The use of cloud technology by MSMEs is expected to become increasingly ubiquitous, advanced, and mature. With continuous advancements in technology and the decreasing costs of cloud services, MSMEs will have access to an even wider range of scalable and cost-effective technology solutions across functions, occupations, and industries. We refer to this potential future state as the “cloud-enabled economy,” a future characterised by high levels of overall cloud technology adoption across Singaporean businesses. It is anticipated that under this scenario, 90% of all businesses would adopt at least a basic level of cloud technology.^{4,5} For many businesses, however, this represents only the beginning of their cloud journey. The escalating sophistication in cloud technology beyond basic applications will be a pivotal driver for economic growth in the future. As MSMEs tap into advanced cloud functionalities, such as AI, data analytics, and serverless computing, they can foster innovation, streamline operations, and customise consumer experiences at scale. These advanced uses can unlock new revenue streams, encourage innovation and the creation of new business models, and enhance competitiveness, collectively underpinning the future of the digital economy.

By 2030, a cloud-enabled, Singaporean economy is expected to deliver even greater societal impact by supporting MSMEs to produce novel, new products and solutions or augment their existing operations. In certain societal sectors, namely health and education, this annual contribution is expected to reach \$650 million. Not only that, but by 2030, cloud-enabled MSMEs are expected to support six million remote health consultations and 200,000 school students to access online education. Cloud-enabled MSMEs are also heavily involved with developing solutions to transition the economy towards a more sustainable future and designing digital finance solutions (through ‘fintechs’) that help to support better financial inclusion and wellbeing.

¹ United overseas bank (2017), Singapore SMEs

² OECD (2023), Share of businesses purchasing cloud services

³ Advanced levels adoption derived from aggregated cloud usage types. See Section 1.2.1.

⁴ Gartner (2022), The future of cloud computing in 2027: From technology to business innovation.

⁵ Gartner (2021), Gartner says cloud will be the centerpiece of new digital experience.

While these benefits are substantial, the opportunities of the cloud-enabled economy will not eventuate without action. To unlock this potential, Singaporean businesses and governments will need to collaborate to foster the continued adoption and maturity of cloud usage.

Businesses can achieve this by:

- identifying how cloud technology can help them scale and deliver global impact
- investing in embedding cloud technology into their strategy; and
- developing a migration plan, and training employees to leverage the benefits of cloud technology.

Singaporean governments can support businesses in achieving a cloud-enabled economy by:

- prioritising cloud education across all levels
- investing in digital infrastructure to ensure innovation can continue unimpeded; and
- and leading by example through promoting cloud adoption across all levels and divisions of government.

1 The cloud-enabled economy

Cloud technology has changed the way many businesses operate, particularly for MSMEs (businesses with between 1 and 250 employees)⁶, by enabling them to scale quickly, reduce costs, reach global markets, and access a range of technology resources that were previously unattainable.

1.1 Cloud technology enables the digital economy

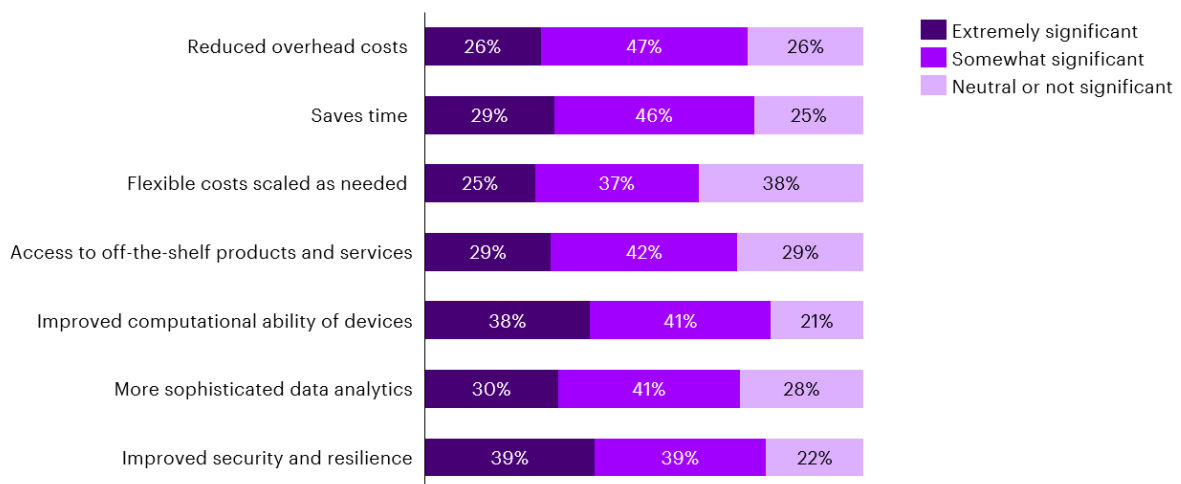
Cloud technology refers to the provision of on-demand IT products and services delivered over the internet or a private network.⁷ This involves housing digital resources from centralised servers owned and operated by cloud service providers, reducing the need for individual businesses to procure and maintain physical hardware. Outsourced technology provides greater flexibility to support MSMEs through the early stages of the business lifecycle by:

- reducing overheads and time to market
- providing greater ability to scale up or down depending on business demands
- offering specialised technology solutions
- increasing computational power of ordinary devices; and
- enhancing security and resilience.⁸

Cloud technology supports MSMEs and helps to enable the digital economy by providing a range of benefits highlighted in Figure 1. The Accenture societal impact survey of cloud-enabled MSMEs conducted for this report indicates that the ability to perform data analytics, enhanced computational power, and improved security and resilience are the features of cloud technology that are most impactful to MSMEs.

Figure 1: The most significant benefits of cloud technology for MSMEs

Average % of cloud-enabled MSMEs across several industries that find cloud somewhat or extremely significant in providing a particular benefit



Source: Accenture societal impact survey (2023), n = 562. 'Neutral or not significant' includes responses of neutral, somewhat insignificant, and not significant at all.

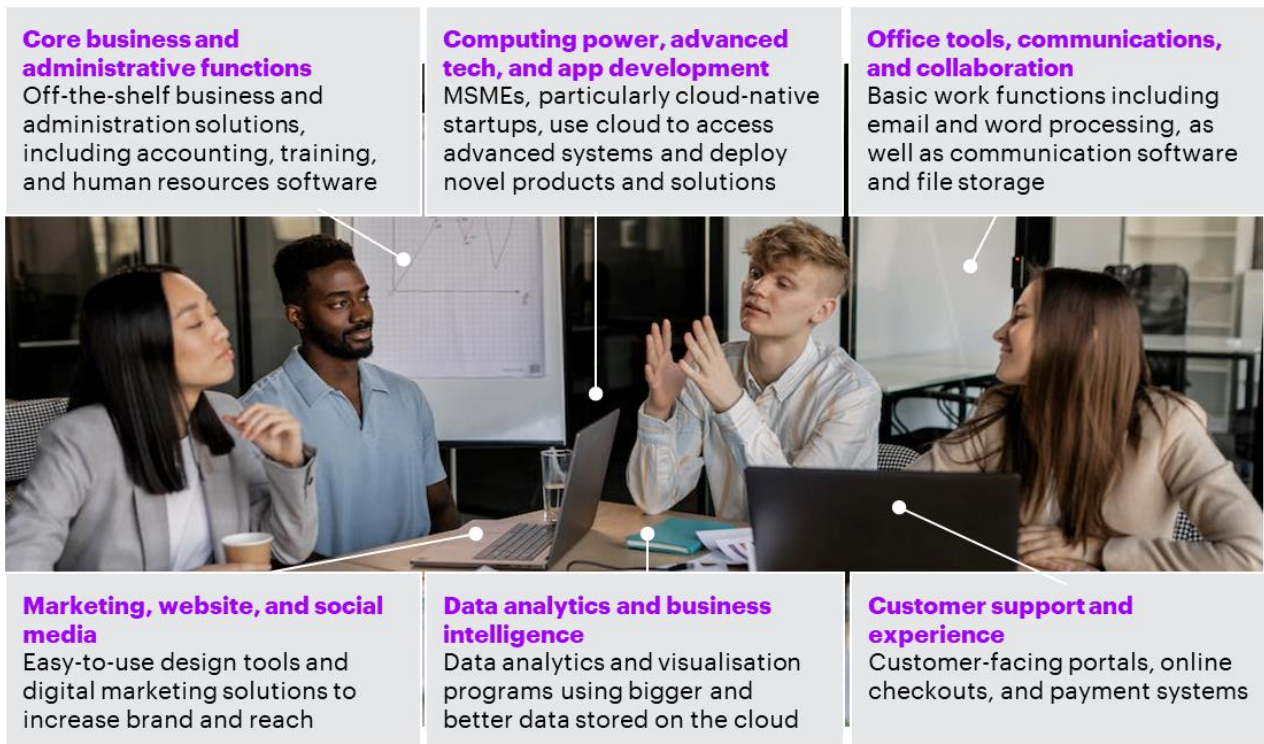
⁶ The definition of MSME used in this report is taken from the OECD (2023) and covers enterprises with businesses between 1-250 employees.

⁷ AWS (2023), What is cloud computing?

⁸ Accenture societal impact survey (2023), n = 562.

By promoting shared resources, the cloud has fundamentally changed the way that individuals and businesses interact with technology, with the number of potential applications of cloud technology far eclipsing simple, remote data storage. Most applications, platforms, and smart products have some functionality facilitated by cloud technology as shown in Figure 2. Having access to on-demand functionalities supports MSMEs to start, operate, and scale their business more efficiently and effectively.

Figure 2: End-to-end cloud technology applications for MSMEs

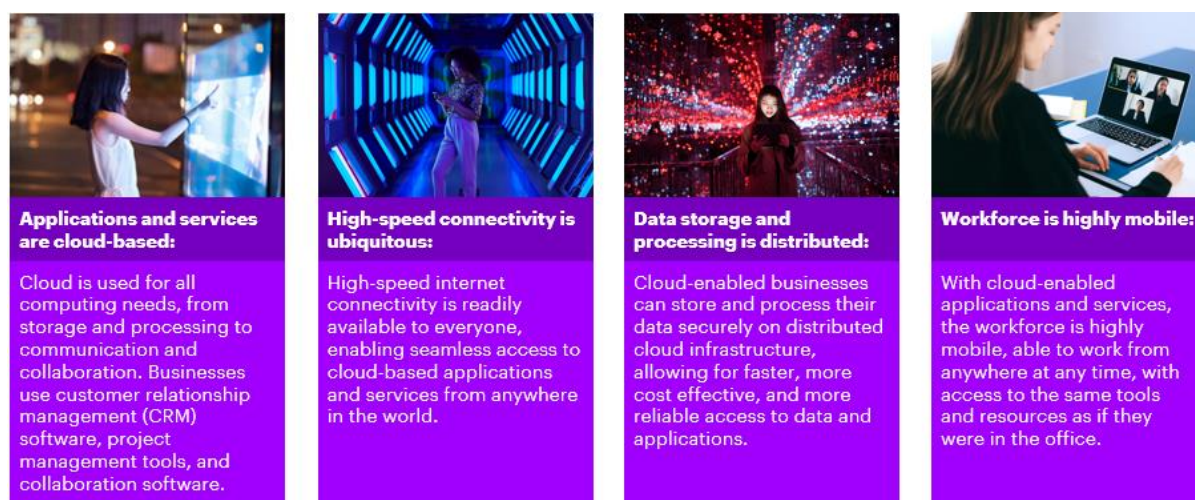


Source: Accenture

1.2 Achieving a cloud-enabled economy can unlock significant societal and economic potential

With continuous advancements in technology and the decreasing costs of cloud services, economies will continue to experience a wave of digital disruption and productivity as businesses find more ways to produce novel, new products and solutions or augment their existing operations. We refer to this potential future state as the “cloud-enabled economy,” a future characterised by high levels of cloud adoption; based on an assessment of cloud industry forecasts, this report expects 90% of all businesses will adopt at least a basic level of cloud technology in a cloud-enabled economy. As cloud technology applications mature, a cloud-enabled economy would increasingly involve digital applications and services being cloud-based, high internet speed and connectivity, cloud-enabled data storage and processing, as well as a mobile workforce (see Figure 3).

Figure 3: Characteristics of a cloud-enabled economy



Source: Accenture

1.2.1 The spectrum of cloud technology adoption

The definition of cloud technology adoption used in this report is consistent with the OECD, and refers to the share of businesses that purchased cloud services⁹ as a proportion of all businesses, across all levels of maturity.¹⁰ However, cloud technologies have a range of applications across a suite of business functions that mean that the use of cloud technology can be considered on a spectrum of maturity or sophistication as shown by the figure below, which includes:

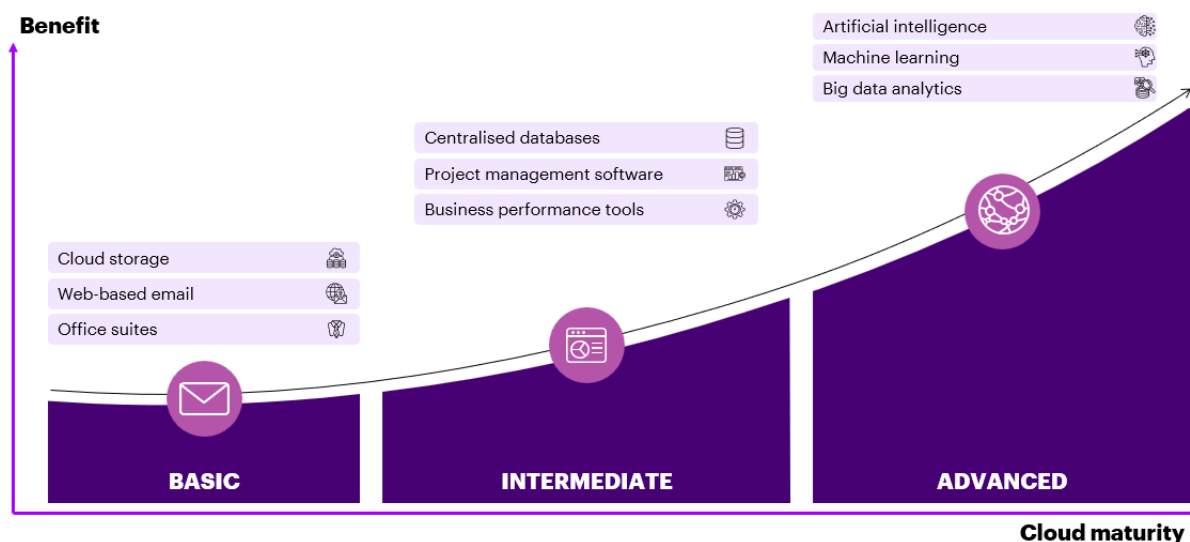
- **Basic adoption:** user-friendly solutions designed for everyday tasks. These solutions typically do not require specialised technical knowledge to operate and primarily serve to simplify and enhance common digital activities. These include simple cloud-based storage solutions, web-based email services, and collaborative office suites.
- **Intermediate adoption:** applications and platforms that cater to more specialised needs but still largely consist of off-the-shelf products with intuitive interfaces. Such tools include customer relationship management, enterprise resource planning, project management tools, developer platforms, and cloud-based databases.
- **Advanced adoption:** highly specialised cloud applications and cutting-edge technologies tailored for expert tasks. This category encapsulates machine learning and AI platforms, big data analytics tools, internet of things (IoT) platforms, serverless computing, container management systems, and advanced security and compliance tools.

As the global economy increasingly digitises, the need for MSMEs to increase their cloud maturity is becoming increasingly pertinent. MSMEs that fail to leverage the scalability of cloud solutions may not only forfeit the ability to compete more effectively with fewer fixed IT costs, but may also pass up more sophisticated data analysis tools, more secure safeguards for digital assets, streamlined compliance with international regulations, and advanced technology applications (such as artificial intelligence, see Section 1.2.2). For many MSMEs to maintain their competitive edge in a dynamic, cloud-enabled economy, the sophistication of their adoption will need to evolve and adapt with the technology according to their specific needs.

⁹ Cloud computing as part of this definition includes information and communications technology (ICT) services that are provided over the internet or a private network to access servers, storage, network components and software applications

¹⁰ OECD (2023), OECD Going Digital Toolkit

Figure 4: Spectrum of cloud maturity and example applications



Note: Applications above are examples of types of uses for each of the levels of maturity. The lists are not exhaustive.
Source: Accenture

1.2.2 Advanced cloud technology usage unlocks the potential for emerging and innovative technologies

Embracing advanced cloud adoption also allows businesses to select from a variety of innovative and cutting-edge technologies to meet their unique business needs and secure a competitive edge in the market. The cloud has increased the viability and proliferation of a wide range of tools, business models, and technologies that, together with the cloud, generate societal and economic impact. Advanced applications of cloud technology include:

- artificial intelligence (AI), encompassing generative AI
- machine learning (ML)
- internet of things (IoT)
- quantum computing; and
- edge computing.

These examples form a growing list of advanced technologies that have become accessible to a wider base of users through the cloud (see Appendix D of the global report for a full description of each technology supported by the cloud).¹¹ Of these technologies, generative AI is experiencing the most rapid and dramatic growth; over the next 10 years generative AI is expected to grow at an annual average rate of 27%.¹² Although the technology has only recently been adopted by the wider public, generative AI is already disrupting and enhancing businesses' processes, accelerating innovation, and facilitating greater speed and creativity across a variety of industries. Businesses and employees are already experimenting with generative AI to create content that supports a range of tasks from writing text and code to generating images.¹³ As shown in Figure 5, 78% of MSMEs across a range of industries and countries identified AI (including generative AI and natural language processing (NLP)) and ML as the technologies likely to be most significant in creating societal impacts in 2030.¹⁴ Generative AI could be used by cloud-enabled MSMEs for a wide variety of applications, such

¹¹ Damian Mazurek, (2023), Leveraging Cloud-based AI/ML Services to elevate your business.

¹² Precedence Research (2023), Generative AI Market size to hit USD 118 Bn by 2032

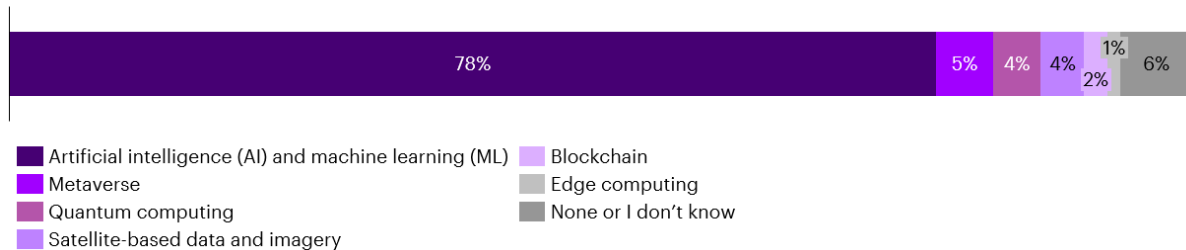
¹³ AWS (2023), Generative AI on AWS.

¹⁴ Survey responses were from MSMEs working in healthcare, education, agriculture, finance, and sustainability.

as helping medical professionals analyse patient data and testing results to inform decision making, or generating practice exam questions and content with instant feedback available to support individualised learning pathways.

Figure 5: Technologies supported by cloud creating the most significant societal impacts in 2030

Average % of cloud-enabled MSMEs across several industries that believe a technology supported by cloud will be the most significant in creating societal impacts in 2030



Source: Accenture societal impact survey (2023), n = 562. ‘Artificial intelligence and machine learning (ML)’ includes subsets generative AI and natural language processing (NLP).

1.2.3 A more productive, cloud-enabled economy offers societal as well as economic benefits

While the opportunity to scale and grow businesses has a clear impact on economic activity (see Chapter 2), in many cases businesses can also create a positive societal impact. The cloud has opened up a range of emerging technologies that are underpinning a new wave of digitally-led innovation to address some of society’s most pressing, global issues. Cloud technology offers MSMEs new ways to produce and commercialise technological solutions that generate positive societal benefits, in addition to economic benefits, across a range of industries. Although this list of industries is not exhaustive, the estimation of the societal impact of cloud technology is focused on the following industries:

- healthcare
- education
- finance; and
- sustainability and disaster response.¹⁵


While these industries are not the only ones that are impacted by cloud technology, these industries face increasingly complex challenges that could lead to less equitable societal outcomes if they do not adapt and harness the benefits offered by cloud technology. These industries are also directly linked to the UN Sustainable Development Goals (SDGs), particularly the overarching objectives of improved healthcare (Goal 3), education (Goal 4), and economic prosperity and equality (Goal 9 and 10).¹⁶

Figure 6 demonstrates through a stylised cameo how cloud technology supports access to these industries for individuals through digitisation.

¹⁵ The report chose to focus on these industries since most societal impact case studies reviewed fell into one or more of these industries. These labels also benefit from matching the economic modelling data as they are taken directly from the International Standard Industrial Classification (ISIC).







¹⁶ United Nations (2023), Sustainable development goals.

Figure 6: The impact of cloud-enabled MSMEs on individuals



This is Kim.

Kim balances part-time work with full-time university. Kim benefits from cloud solutions delivered by businesses to make her day easier and more productive.

<p>Telehealth services</p> <p>Kim has a doctor’s appointment before work. Through telehealth, Kim can now talk to her doctor virtually. Her doctor can also access and upload her medical information to Kim’s secure online health record.</p>	<p>8:00 am</p> 	<p>No longer needs to ...</p> <ul style="list-style-type: none"> × Spend two hours driving to the doctor and waiting in the office × Be near people who are sick × Worry about her doctor not having access to her records 	<p>Examples</p> 
<p>Access to education</p> <p>After getting home from work, Kim logs in for her online tutoring class. Whilst the tutor is based in the United States, Kim and her 10 classmates from around the world have access to additional learning material, that enables collaboration with people from different backgrounds.</p>	<p>3:00 pm</p> 	<p>No longer needs to ...</p> <ul style="list-style-type: none"> × Leave work early to travel to university × Be restricted to the limited lecture and tutor times offered by the university 	<p>Examples</p> 
<p>Spending insights</p> <p>Before bed, Kim reviews her weekly spending data on a new finance app. The app uses cloud to securely classify and store her spending patterns, to identify new ways Kim can cut costs. This week, Kim has saved \$35 from cancelling unused subscriptions!</p>	<p>6:30 pm</p> 	<p>No longer needs to ...</p> <ul style="list-style-type: none"> × Spend lots of time balancing her budget × Worry about exceeding her weekly budget on purchases × Carry cash for basic payments 	<p>Examples</p> 

Notes: Examples include MSMEs and startups using cloud solutions from AWS case studies
 Source: AWS¹⁷

¹⁷ AWS (2023), Customer Success Stories.

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2 Unlocking \$650 million in productivity benefits within key societal sectors

MSMEs are a major driver of economic performance in Singapore, accounting for about 99% of all firms, 65% of jobs, and about 48% of Gross Domestic Product (GDP).¹⁸ Cloud technology is helping to create and scale MSMEs (see Chapter 1), the impact of which can be identified in overall, aggregate economic performance. The impact of further cloud adoption and maturity on aggregate economic output is estimated with a novel economic model, based on analysing current data that captures the relationship between adoption and economic activity. In Chapter 3, this analysis is taken to the next level of granularity, assessing how much of this impact can be attributed to key societal sectors of healthcare, and education.

Box 1: Modelling the economic potential of a cloud-enabled economy

This research estimates the impact of cloud on economic productivity at the country level using data from the OECD to capture the relationship between cloud adoption rates and GDP (controlling for capital and labour inputs). A full explanation of the modelling approach, data, and outputs can be found in Appendix A of the global report.

Singapore is well positioned to transition to a cloud-enabled economy with already high levels of cloud adoption.¹⁹ The share of all businesses using at least some basic level of cloud technology in their business operations is at 64%, growing from 34% as recently as 2014.²⁰ Despite this, the rate of adoption for intermediate and advanced technology is expected to be far lower, based on an assessment of other developed OECD economies.²¹ On average across the OECD, overall adoption rates sit at 44%, although adoption of intermediate and advanced applications are 19% and 13% respectively.²²

The range of new technologies underpinned by the cloud is accelerating, with advances in technologies such as generative AI, that also offer significant economic and societal potential. Continued investment from Singaporean industries and governments is required to continue realising the benefits of the cloud-enabled economy.



¹⁸ United overseas bank (2017), Singapore SMEs

¹⁹ For consistency across modelling, we use adoption rates as reported by the OECD which refers to the share of all businesses purchasing cloud services. OECD values may differ from those reported by local statistical agencies.

²⁰ Accenture analysis of OECD data. See global report for full methodology.

²¹ Accenture analysis of OECD data. See global report for full methodology.

²² OECD (2023)

The productivity benefits of the cloud-enabled economy to societal sectors in Singapore would be significant. Through successful transition to a cloud-enabled economy, MSMEs in the healthcare and education industries within Singapore are expected to unlock \$650 million in combined annual productivity benefits by 2030, a 25% increase from \$520 million.²³ Under this scenario, it is estimated that 100,000 people would work at cloud-enabled MSMEs in these industries, an increase from 50,000 people currently. This reflects the increasing ubiquitousness of cloud technology in almost all forms of digital technology and occupations across the economy.

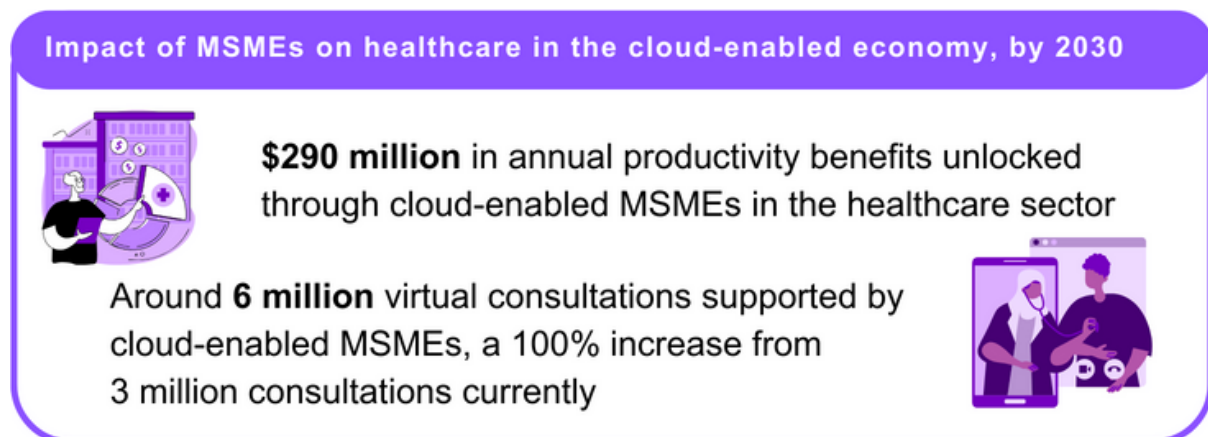
²³ All monetary values are quoted in Singapore (2023) dollars unless otherwise specified.

3 The societal impact of the cloud-enabled economy

MSMEs that harness cloud technology have the potential to create significant societal impact in Singapore. We define “societal impact” in reference to the positive changes and improvements in outcomes facilitated by cloud technology in areas such as healthcare and education. By leveraging cloud technology, MSMEs can enhance the efficiency, affordability, and accessibility of services in these industries, enabling advancements such as telemedicine, online education, financial access and autonomy, and sustainable technology. These solutions will lead to improved social wellbeing and development.

3.1 Driving innovation and improving access to healthcare and life sciences

Singapore’s healthcare system is considered to be one of the best in the world, however, the long-term viability of the system is threatened by challenges associated with an ageing population.²⁴ Nearly 20% of Singapore’s population is over the age of 65, placing a greater burden on health and aged care.²⁵ MSMEs are implementing technology, such as the cloud, to innovate and drive greater efficiency in order to accommodate these demographic challenges. Through remote consultations and monitoring of health indicators, cloud technology can help make healthcare more accessible to communities throughout Singapore. Along with enabling remote healthcare, cloud technology can enable the use of patient analytics for healthcare decisions and personalised treatment. If Singapore were to achieve a cloud-enabled economy, MSMEs in healthcare are expected to unlock \$290 million in annual productivity benefits by 2030. Cloud-enabled MSMEs are expected to support six million virtual health consultations per year by 2030.²⁶



Note: Estimates for the number of telehealth consultations produced through market size estimates (see Appendix C of the global report) and are calculated separately to the GDP contribution. Current values are annual 2022-2023 values based on the latest available data.

Technologies supported by the cloud, particularly generative AI, also have significant potential to change the healthcare industry, from the delivery of healthcare to administrative functions. While generative AI is still a nascent technology, MSMEs can use it to support

²⁴ The New York Times (2017), What makes Singapore’s health care system so cheap?

²⁵ The Straits Times (2022) S’pore’s population ageing rapidly: Nearly 1 in 5 citizens is 65 years and older

²⁶ Remote health consultations can also be supported by telephone or through large cloud-enabled firms.

clinical decision making, helping medical professionals analyse data more accurately, along with supporting efficiency in research and development.²⁷

Cloud technology is also important for streamlining administrative tasks, creating efficiency for healthcare providers. MSMEs are using cloud technology to improve the efficiency of healthcare administration and allow providers to collaborate with other healthcare workers on treatment. Tetsuyu Healthcare is a cloud-based MSME in Singapore, using software to support community care providers in managing their workloads, collaborating, and keeping patient information accurate (see Case Study below).²⁸

²⁷ WE Forum (2023), How will generative AI impact healthcare?

²⁸ Tetsuyu Healthcare (2023).

Tetsuyu Healthcare uses a cloud-based app to facilitate communication and collaboration for better at-home, community care



Industry:
Healthcare



Size: Small
(<50 employees)



Locations: Singapore and Hong Kong

Tetsuyu Healthcare is a health tech startup based in Singapore. Their software and applications address viability constraints with community care providers. Community care can be fragmented, highly localised, and manual, requiring service providers to engage in costly administration and limiting their ability to scale and serve more patients. Manual administration also makes record keeping and communication between providers challenging, leading to patients not receiving continuity of care.

“Most people want to age with dignity in their own home, but the costs of operating effective, responsive and affordable community care is not always viable at scale. Our platform helps community care providers to cut back on administration, reduce reliance on paper-based notes, and integrate seamlessly with doctors, patients, and carers.”

Li Lian Ng, Co-founder and Director.

Tetsuyu Healthcare's 'CARES' platform allows clinicians and care staff to collaborate and share information for more coordinated care. Community care providers are able to manage patient information, conduct administrative tasks, and conduct remote assessments via mobile and web apps. Providers can also use the system to manage referrals, assign clients, manage care plans, engage via telehealth, and discharge patients. Caregivers or family members can access the app as needed, enabling them to engage and communicate with health practitioners. Importantly, patients can also engage with the app, sharing information such as their medication history or



messages from specialists with other providers, enabling continuity of care.

Tetsuyu Healthcare is a cloud-native small business and attributes the ability to expand their services across geographies rapidly. Healthcare data is subject to strict data policies and operating through a cloud provide streamlined compliance with local data laws, not to mention assurances to patients and healthcare providers. Tetsuyu Healthcare is using cloud to bring advanced analytics to the healthcare sector including an AI tool (CARES4WOUNDS) that enables nurses and practitioners to measure and analyse wounds with a mobile application in under 1 second. Practitioners simply take a wound image with their mobile phone camera and the wound assessment is quickly completed and saved on the cloud. This saves time on manual evaluations and documentation whilst reducing human error and increasing the chance of earlier intervention.

CARES4WOUNDS is just the start of AI applications in healthcare sector, suggesting that AI has much to offer in areas such as patient diagnoses, clinical trials, and hospital administration.

Source: Accenture consultation; Tetsuyu Healthcare (2023)

3.2 Improving access to engaging and personalised education

MSME education services which utilise the cloud are improving access to quality education. Cloud technology can make education more equitable, safe, and accessible by providing new learning opportunities for a wider audience, including remote communities or adults with limited time who are looking to boost or diversify their skills. These students and adults will be able to learn in a more collaborative environment, as cloud technology supports them to interact and share content more readily. Testing also becomes more convenient for students and adults, enabling them to ensure they understand the material. Serious Games Asia is a cloud-based MSME in Singapore, using assessment games to support ongoing learning for adults (see Case Study below).²⁹ Under a cloud-enabled economy, MSMEs in education are expected to unlock \$360 million in annual productivity benefits by 2030. Through supporting the education industry, cloud-enabled MSMEs are expected to facilitate 200,000 school students and one million adults in Singapore to receive online learning by 2030.

Impact of MSMEs on education in the cloud-enabled economy, by 2030



\$360 million in annual productivity benefits unlocked through cloud-enabled MSMEs in the education sector

Around **200,000** primary to high school students using online education via cloud-enabled MSMEs, a 100% increase from 100,000 students currently



Around **1 million adults** accessing education via cloud-enabled MSMEs

Note: Estimates for the number of students and adults accessing cloud-based education produced through market size estimates (see Appendix C of the global report) and are calculated separately to the GDP contribution. Current values are annual 2022-2023 values based on the latest available data.

MSMEs are also utilising cloud technology to provide advanced analytics, giving students and teachers more insights about the learning process. Personalised content and feedback can help students with different learning styles work at their own pace, not to mention reduce the administration burden on teaching staff. Educators can also use cloud-based learning analytics to check whether students are engaged with their learning environment.

²⁹ Serious Games Asia (2023).

Serious Games Asia provides immersive and realistic virtual training scenarios through cloud to standardise and develop occupational skills



Industry:
Education



Size: Micro
(<10 employees)



Location: Singapore

Serious Games Asia is a startup based in Singapore that works with qualified instructors, training institutions, and game developers to provide immersive training experiences (desktop, virtual reality, MxR, multiplayer) through a single platform. Many specialised occupations, such as nurses and medical practitioners, require regular hands-on training and certifications to upskill the workforce and ensure best-practice. Providing this training is costly and, in an industry with a large workforce such as healthcare, is difficult to implement at scale.

“The size of the Singapore healthcare practitioner workforce means that training and skills becomes localised and disparate across regions and hospitals. Leveraging cloud, Serious Games Asia helps standardise training and qualifications, while improving the scalability, frequency and cost of training practitioners.”

Ivan Boo, Founder and Managing Director.

"Serious games" is the term given to games that are designed not purely for entertainment but to present a possible solution, simulate workplace scenarios and substitute in-person examination and training. Named after this concept, Serious Games Asia is working with SingHealth in acute hospitals, community hospitals, and specialist centres to design virtual experiences that mirror real workplace procedures. The game system monitors each trainee's choices and their steps taken to reach their final decision, meaning that their performance is no



longer based on overall performance but rather the pathways the participants has chosen, allowing for a more complete assessment of competency. Serious Games Asia's virtual training games currently help to train over 3,000 nurses annually (14% of the workforce) across Singapore.

The cloud allows Serious Games Asia to provide training scenarios on-demand and at scale across multiple hospitals and education institutions. Hosting the game assets on cloud allows for seamless updates and changes to practices or assessments implemented across the entire workforce within an organisation. Built on cloud, hospitals can quickly access the training platform, and easily customize different training assets and scenarios to meet specific requirements or context. Both trainers and trainees can engage directly with their results upon completion of the game, helping to analyse and evaluate decisions made. For workplace competencies, to understand exactly where mistakes are is more important than the overall performance.


Source: Accenture consultation; Serious Games Asia (2023)

3.3 Improving financial access and wellbeing

The digitisation of the finance sector has led to wave of disruption, increased competition, and new types of products and services that better service customers.³⁰ Alongside the rapid adoption of smart devices, a critical part of the proliferation of digital finance options has been cloud technology that supports fast and secure methods of transferring financial information and better access to information.³¹ As such, cloud-native MSMEs in the finance industry (referred to as fintechs) represent one of the fastest growing markets in the world, expected to rise from US\$134 billion in 2022 to US\$557 billion globally by 2030 – more than a 400% increase.³²


The rise of fintech apps has not only been seen in an increase in the number of financial services companies, but also a boost in convenience and access, individual autonomy over financial decisions, better access to information, and tighter security frameworks. According to the Accenture societal impact survey, by 2030, one in four people globally are expected to be using financial services supported specifically by cloud-enabled MSMEs.³³ Globally, 15% of cloud-enabled MSMEs working with the finance sector are expected to be helping budget-constrained customers or small businesses to better manage their finances.^{34,35} AI has the potential to unlock even greater individual financial wellbeing in a cloud-enabled economy by allowing customers to automate more elements of personal finances.³⁶ While this technology is still nascent, the possibility of integrating AI to perpetually monitor and screen for better fees or financial products holds enormous potential to improve financial health.³⁷

Impact of MSMEs on finance in a cloud-enabled economy by 2030



1 in 4 people globally using financial services supported by cloud-enabled MSMEs

Globally, **15%** of surveyed cloud-enabled MSMEs working with the finance sector help budget-constrained customers or small businesses better manage their finances



Source: Accenture societal impact survey (2023), n = 188. Based on global results across 12 countries.

For many countries, a cloud-enabled financial services sector is not far away, with many MSMEs already incorporating or exploring the use of cloud-supported technologies, such as AI and ML, to improve outcomes for consumers across a range of applications.³⁸ A sample of MSMEs operating in the financial services space globally indicated that the most common areas for these MSMEs to be active were in providing digital banking and budgeting or financial management tools.^{39,40} The improvements in societal outcomes most often

³⁰ OECD (2020), "Digital disruption in banking and its impact on competition".

³¹ Ibid.

³² Vantage market research (2023)

³³ Accenture societal impact survey (2023), n = 188.

³⁴ Accenture societal impact survey (2023), n = 188.

³⁵ Based on the number of cloud-enabled MSMEs currently supporting this outcome.

³⁶ Crunchbase (2023) How the future of personal finance is self-driving money

³⁷ Crunchbase (2023) How the future of personal finance is self-driving money

³⁸ IMF (2021), Powering the Digital Economy: Opportunities and Risks of Artificial Intelligence in Finance.

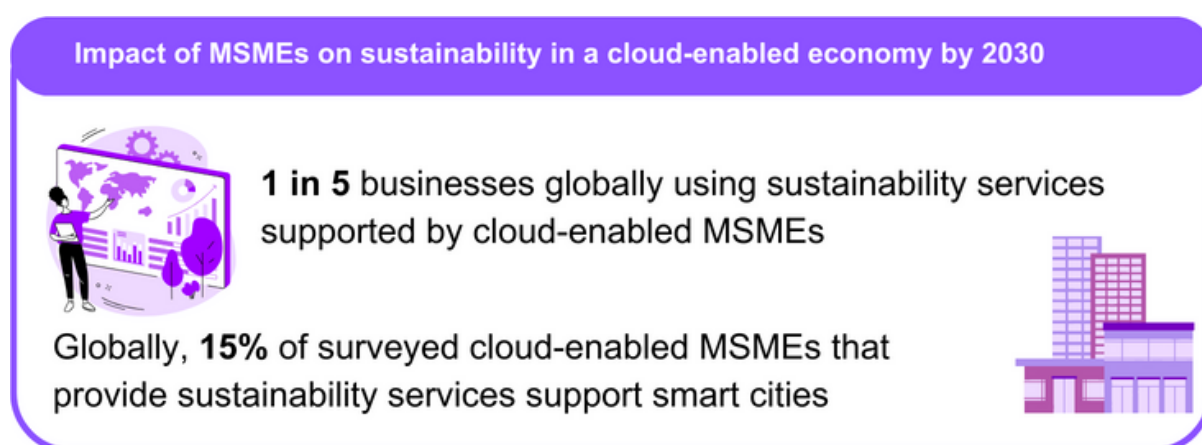
³⁹ Accenture societal impact survey (2023), n = 188.

⁴⁰ Based on the services that cloud-enabled MSMEs are currently delivering.

attributed to these MSMEs were increased affordability of services, improved financial literacy and education, and fraud detection.^{41,42}

3.4 Designing a sustainable future

Developing the tools and technologies that will support a sustainable future is one of the most pressing global challenges, but also one filled with enormous economic potential. Cloud-enabled MSMEs can employ technology and digitisation to directly reduce environmental impact through innovations such as more efficient resource usage and smarter waste management. According to the Accenture societal impact survey, by 2030, one in five businesses globally are expected to be using services provided by cloud-enabled MSMEs to directly address their climate and sustainability objectives, such as through energy or emissions monitoring and reduction.⁴³ And it's not only businesses using these services; across the world, cities and towns are increasingly turning to cloud-based technology solutions provided by MSMEs to achieve a range of sustainable outcomes.^{44,45} Smart cities are using a wide range of technologies supported by cloud-enabled MSMEs, including AI, to create societal impact and improve sustainability, such as through environmental monitoring and data-driven urban planning.^{46,47,48,49} Globally, 15% of cloud-enabled MSMEs providing services to achieve sustainability goals are expected to be supporting "smart cities".^{50,51}



Source: Accenture societal impact survey (2023), n = 66. Based on global results across 12 countries.

According to the Accenture societal impact survey of global MSMEs, cloud technologies have already enabled these businesses to provide smarter resource management and usage, access to sustainable and renewable technologies, carbon footprint monitoring, and sustainability information.⁵² Through these sustainable solutions, global MSMEs are helping to support wider sustainability goals including more efficient use of energy and water, improving waste management, supporting better air quality, and increasing the availability of renewable energy.⁵³

⁴¹ Accenture societal impact survey (2023), n = 188.

⁴² Based on the number of cloud-enabled MSMEs currently supporting this outcome.

⁴³ Accenture societal impact survey (2023), n = 66.

⁴⁴ IDC (2023), Smart Cities.

⁴⁵ IDC (2021), The Next Frontier: AI and Digital Twins in Smart Cities.

⁴⁶ AWS (2023), Building Smart Cities with AWS Cloud.

⁴⁷ IDC (2023), Smart Cities.

⁴⁸ IDC (2021), The Next Frontier: AI and Digital Twins in Smart Cities.

⁴⁹ OECD (2021), Measuring smart city performance in COVID-19 times: Lessons from Korea and OECD countries.

⁵⁰ Accenture societal impact survey (2023), n = 66.

⁵¹ Based on the number of cloud-enabled MSMEs currently supporting this outcome.

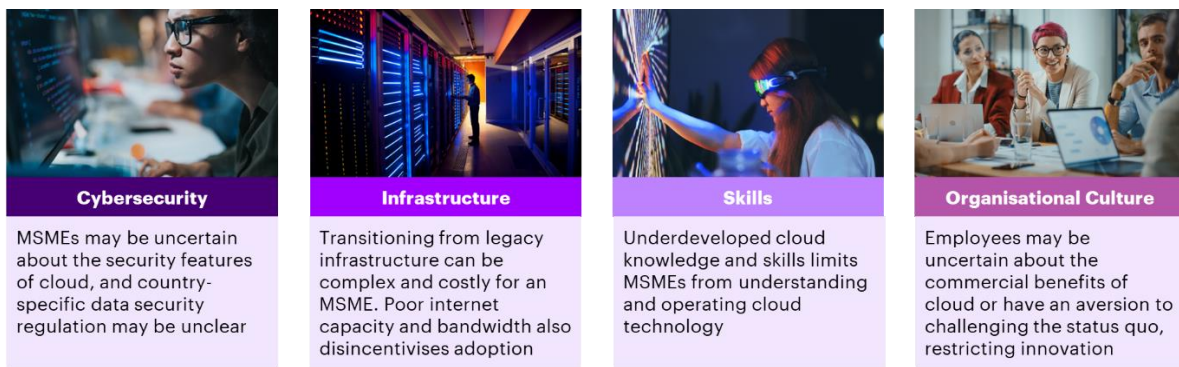
⁵² Accenture societal impact survey (2023), n = 66.

⁵³ Accenture societal impact survey (2023), n = 66.

4 Achieving the cloud-enabled economy

The cloud-enabled economy offers significant potential in terms of both economic and societal impact. With 64% of businesses adopting at least a basic level of cloud technology as of 2021, Singapore’s path towards a cloud-enabled economy has more to do with using cloud technology in new ways within firms who have already adopted, rather than pursuing the businesses that continue to operate outside of the cloud. To unlock this potential, the focus shifts to maturing cloud usage across more complex business functions and implementing more advanced technologies supported by cloud including AI and ML. Unlocking these opportunities by 2030 requires continued coordinated action from industry and Singaporean governments to address the barriers to cloud uptake. The main persistent barriers to adopting cloud technology are included in Figure 7.

Figure 7: Firm-level barriers to cloud adoption



Source: Accenture⁵⁴

To address each of these complex challenges MSMEs should evaluate barriers at the firm level, to identify specific security, IT resources, organisational culture, and skills required to be successful. This will help MSMEs to develop holistic cloud solutions, optimised and scaled to improve performance, and reduce costs.

⁵⁴ Accenture (2023), The race to cloud: Reaching the inflection point to long sought

4.1 Holistic strategies to overcome firm-specific barriers to cloud adoption

MSMEs can adopt a range of internal policies and actions to adopt cloud solutions across all business functions, thereby maximising their productivity dividend overtime (see Figure 8).

Figure 8: Steps for MSMEs to accelerate cloud maturity

Steps	Description	Barriers addressed			
		Cybersecurity	Infrastructure	Skills	Organisational culture
1 Identify how cloud can streamline strategic goals	<ul style="list-style-type: none"> Identify how cloud solutions can meet your goals Identify a cloud partner that can help navigate the process Examine case studies of how MSMEs have used cloud to transform their business and create impact Interview employees to determine which barriers are preventing these systems and/or processes from being introduced or optimised at the firm level 				✓
2 Evaluate industry and government support	<ul style="list-style-type: none"> Examine the Singaporean government’s cloud policies and programs offered by industry to address firm-specific barriers and accelerate cloud maturity This could include R&D tax credits from the Singaporean government, or sponsorship programs for startups run by cloud providers such as AWS 	✓	✓	✓	✓
3 Educate all employees	<ul style="list-style-type: none"> Support employees to upskill in cloud, and utilise training from cloud providers where relevant Identify specific skill shortages to focus their training 	✓		✓	✓
4 Review data security arrangements	<ul style="list-style-type: none"> Review data security arrangements from the cloud provider and determine whether additional internal policies are required Review security features of cloud and best practice data policies Simplify and harmonise policy across the business, with clear guidelines for different functional applications of cloud 	✓			
5 Create a whole-of-business cloud migration strategy	<ul style="list-style-type: none"> Evaluate the costs and benefits of alternative strategies to determine a whole-of-business solution that meets business goals MSMEs should prioritise solutions which deliver the greatest net benefit in the medium to long term Determine the scale and complexity of the cloud infrastructure required MSMEs with less cloud experience could consider enlisting cloud partners such as consultants to achieve this 	✓	✓	✓	✓

Source: Accenture

4.2 Strong policy support to address structural barriers and incentivise MSME cloud adoption









Singapore is known for introducing some of the most ambitious policies to accelerate their digital economy. This includes a variety of policies addressing the barriers to cloud adoption discussed in Section 4.1. Most notably, Singapore has one of the fastest internet speeds in the world, attributable to significant investment into optic fibre broadband.⁵⁵ Singapore is also ranked second on talent affinity for cloud adoption, supported by strong mathematics and engineering outcomes and cloud training initiatives.⁵⁶ To reach their cloud potential by 2030 and drive the maturity of cloud within businesses, Singapore can look to global examples from other leading digital economies (see Figure 9).

⁵⁵ Lim, S. (2019), The city of the future: What will a full-fiber broadband city look like

⁵⁶ MIT Technology Review (2022), Global Cloud Ecosystem Index 2022

Figure 9: Global best-practice examples of cloud adoption policies

■ Cybersecurity ■ Infrastructure ■ Skills ■ Organisational culture

Policy	Key existing support	Future policy	International policy examples	Barriers addressed
Invest in digital infrastructure	Singapore has one of the fastest internet networks globally, with 93% of broadband connections being optic fibre in 2019. 91% of the population is connected to the internet.	Continue investing in optic fibre to expand internet coverage in regional and rural areas.	 Norway has connected 99% of the population to the internet  South Korea has connected 98% of the population to the internet	<div style="display: flex; justify-content: space-around;"> <div style="width: 20px; height: 20px; background-color: #000000;"></div> <div style="width: 20px; height: 20px; background-color: #0000FF;"></div> <div style="width: 20px; height: 20px; background-color: #0000FF;"></div> <div style="width: 20px; height: 20px; background-color: #000000;"></div> </div>
Invest in cloud skills and training	An estimated 63% of Singaporeans use basic digital skills in their jobs. The government has supported digital skills through programs such as the TechSkills Accelerator (TeSA) initiative, which involves collaboration with industry to deliver ICT training to individuals and businesses.	Continued collaboration with industry to deliver digital skills training programs, with a focus on cloud technology. This should be especially targeted to MSMEs.	 Australia's National Cloud Computing Strategy includes cooperation with industry and educators to enhance cloud training  Brazil's Digital Transformation Strategy (E-Digital) includes partnerships with industry and educators to provide cloud training and certifications	<div style="display: flex; justify-content: space-around;"> <div style="width: 20px; height: 20px; background-color: #000000;"></div> <div style="width: 20px; height: 20px; background-color: #0000FF;"></div> <div style="width: 20px; height: 20px; background-color: #0000FF;"></div> <div style="width: 20px; height: 20px; background-color: #000000;"></div> </div>
Harmonise data privacy policy across regions	Singapore's Personal Data Protection Act (PDPA) has adequacy status with the EU GDPR. Instead of data localisation requirements, data adequacy principles promote cross border data flows with countries that have similar data security standards. The policy relies on frameworks such as the Asia Pacific Economic Cooperation (APEC) Cross-Border Privacy Rules (CBPR).	Continue working with world leaders to harmonise policy in line with best practice to expand cross-border data flows.	 European Union's General Data Protection Regulation (GDPR, 2016) improved clarity and consistency across the EU, promoting data flow within the EU	<div style="display: flex; justify-content: space-around;"> <div style="width: 20px; height: 20px; background-color: #000000;"></div> <div style="width: 20px; height: 20px; background-color: #0000FF;"></div> <div style="width: 20px; height: 20px; background-color: #0000FF;"></div> <div style="width: 20px; height: 20px; background-color: #000000;"></div> </div>
Incentivise cloud adoption and maturity	Singapore provides multiple incentives, including the Productivity Solutions Grant (PSG) for businesses adopting cloud. The government also offer tax deductions for expenses incurred on cloud software and equipment. From 2013-18, this included the Productivity and Innovation Credit (PIC) Scheme, where cloud costs were 400% tax deductible or 60% cash back.	Continued ongoing support for MSMEs to reduce the cost of transitioning to cloud and encourage innovation.	 United States' incentives include cloud being fully tax deductible and tax credits for cloud-related investments  Australia's Small Business Technology Investment Boost and Small Business Skills and Training Boost has a temporary 120% tax deduction on cloud training and systems costs for small businesses in 2023	<div style="display: flex; justify-content: space-around;"> <div style="width: 20px; height: 20px; background-color: #000000;"></div> <div style="width: 20px; height: 20px; background-color: #0000FF;"></div> <div style="width: 20px; height: 20px; background-color: #0000FF;"></div> <div style="width: 20px; height: 20px; background-color: #000000;"></div> </div>
Improve cloud-first policies	Singapore's Government Technology Agency (GovTech) is investing in migrating eligible government systems to cloud. They are on track to reach the target of 70% by Q3 2023.	Continue developing public cloud-first strategies, taking key learnings and best practice principles to expand procurement targets and approaches.	 United Kingdom's Cloud-First policy (2013) is a whole-of-government, public cloud-first approach that outlines clear guidelines and procurement policies for departments	<div style="display: flex; justify-content: space-around;"> <div style="width: 20px; height: 20px; background-color: #000000;"></div> <div style="width: 20px; height: 20px; background-color: #0000FF;"></div> <div style="width: 20px; height: 20px; background-color: #0000FF;"></div> <div style="width: 20px; height: 20px; background-color: #000000;"></div> </div>

Source: Lim, S.,⁵⁷ World Bank,⁵⁸ AlphaBeta,⁵⁹ Government of Singapore,⁶⁰ Australian Government,⁶¹ Federal Government of Brazil,⁶² Low, L. A., Wyson, W., & Burney, A.,⁶³ GDPR EU,⁶⁴ Tan, A.,⁶⁵ Personal Data Protection Commission Singapore,⁶⁶ Coos, A.,⁶⁷ Government of Singapore,⁶⁸ CloudGo⁶⁹, Mcguire Sponsel,⁷⁰ Australian Government,⁷¹ GovTech Singapore,⁷² Teng, R.,⁷³ UK Government⁷⁴

⁵⁷ Lim, S. (2019), The city of the future: What will a full-fiber broadband city look like

⁵⁸ World Bank (2021), Individuals using the Internet (% of population)

⁵⁹ AlphaBeta (2021), Unlocking APAC's Digital Potential: Changing Digital Skills Needs and Policy Approaches

⁶⁰ Government of Singapore (2023), TechSkills Accelerator (TeSA)

⁶¹ Australian Government (2013), The National Cloud Computing Strategy

⁶² Federal Government of Brazil (2018), Brazilian Digital Transformation Strategy

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- ⁷² GovTech Singapore (2020), Developing ICT systems on the cloud helps the Government deliver more agile and user-centric digital services
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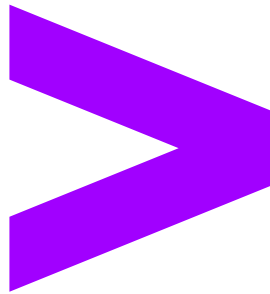
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